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Natural Hazards and Earth System Sciences
Discussions

"We can help us": Does Community Resilience Buffer Against the Negative Impact of Flooding on Mental Health?

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Natural Hazards and Earth System Sciences
Discussions

Abstract

Empirical evidence on the relationship between social support and post-disaster mental health provides support for a general beneficial effect of social support (main-effect model; Wheaton, 1985). From a theoretical perspective, a buffering effect of social support on the relationship between disaster-related stress and mental health also seems plausible (stress-buffering-model; ibid.). Previous studies however a) have paid less attention to the buffering effect of social support and b) they have mainly relied on interpersonal support (but not collective-level support such as community resilience) when investigating this issue. This work might has underestimated the effect of support on post-disaster mental health. Building on a sample of residents in Germany recently affected by flooding ($N = 118$), we show that community resilience to flooding (but not general interpersonal social support) buffered against the negative effects of flooding on post-disaster mental health. The results support the stress-buffering model and call for a more detailed look at the relationship between support/resilience and post-disaster adjustment, including collective-level variables.

Keywords: Flooding, mental health, community resilience, social capital, well-being.
Word count: 5987 (excluding references, tables and figures)

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Natural Hazards and Earth System Sciences
Discussions

"We can help us": Does Community Resilience Buffer Against the Negative Impact of Flooding on Mental Health?

On the global scale, flood is one of the most destructive natural hazards, with rising numbers both in terms of the people affected by flooding and the damage attributable to floods (Fattorelli et al., 1999). For example, experts calculated that the annual flood-related losses in Germany may rise from about €500 million in 2001 up to €2 billion by 2100 (Hattermann et al., 2016; Thieken et al., 2016; Thieken et al., 2005). However, flooding does not only incur substantial financial costs on societies, but also threatens people's health and life (Alderman et al., 2012). An example of the devastating potential of flooding is Typhoon Haiyan killing more than 3,900 people when it hit the Philippines in 2013. Previous research has also documented the negative effects of severe flooding experiences on peoples' physical and mental health, such as increased injuries but also increased psychiatric symptoms (e.g., (Ahern et al., 2005; Alderman et al., 2012).

A recent review indicates that different factors may be associated with the severity of mental health problems caused by flooding experiences, including flood characteristics (e.g. level of exposition), personal factors (e.g., coping styles, previous flood experience), and social factors (e.g. social support; Fernandez et al., 2015). While a substantial body of literature has investigated how personal and flood characteristics influence post-disaster mental health (cf. Brewin et al., 2000; Lamond et al., 2015), less is known about the effects of social factors (Fernandez et al., 2015; Twigger-Ross et al., 2011; but see Bonanno et al., 2010). Furthermore, past studies have tended to focus on single factors contributing to mental health outcomes but fewer studies investigated the interplay between different types of social factors to explain these outcomes.

The present research aims to advance the understanding of how social factors may interact with other (flood-related) factors in explaining the mental health impacts of flooding. Specifically, it investigates how social resources on the community level (i.e. perceived

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Natural Hazards and Earth System Sciences
Discussions

community resilience to natural hazards; (Pfefferbaum et al., 2013) can help to buffer against the negative effects of flooding on mental health (stress-buffering model; Wheaton, 1985). For this purpose, we analyze data of 118 respondents of a questionnaire survey gathered immediately after a severe flood event in the German federal state Bavaria in 2016. The article is structured in the following way: It first provides an overview of past research on flooding and mental health and of the personal and social factors affecting how people can cope effectively with traumatic experiences. We then present our research hypotheses about the direct and indirect effects of interpersonal-level and collective-level social support (community resilience) on mental health outcomes of flooding experiences. After the presentation of the results, the article concludes with a discussion of the findings and suggestions for future research.

Floods, resilience, and mental health

Previous reviews collected evidence showing that (financial and non-financial) flooding losses and the stress caused by these losses deteriorate people's mental health condition: Respondents exposed to severe flooding reported more depression, anxiety and psychosomatic symptoms (headache, bodily pain) and had a higher probability of post-traumatic stress disorder (Alderman et al., 2012). Results also indicate that flooding experiences affected negatively people's psychological wellbeing and – at least in some studies – led to increased medication usage (Fernandez et al., 2015). Many of the negative impacts of flooding experiences on mental health are transitory and do not develop into clinical disorders (Bonanno et al., 2010; Stein etal., 2007). However, sustained negative health outcomes were also found in a number of studies (Carroll et al., 2009; Du et al., 2010; Kraemer et al., 2009; Medd et al., 2015; Tapsell and Tunstall, 2008; van Ootegem and Verhofstadt, 2016; Whittle et al., 2012); see Ohl and Tapsell, 2000, for an early review). For example, Sekulova and van den Bergh (2016) showed that experience of flooding decreased life satisfaction up to six years after the flood event (von Möllendorff and Hirschfeld, 2016)

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Natural Hazards and Earth System Sciences
Discussions

Although floods often have negative mental outcomes, not all people exposed to flooding are affected equally in terms of health problems. Previous research has identified several factors that are supposed to mediate or moderate the impact of flooding experiences on mental health, including personal factors, flood characteristics, and social factors (Fernandez et al., 2015). Personal factors refer to individual-level characteristics like socioeconomic characteristics, existing health problems, but also (cognitive) coping styles (Bei et al., 2013; Carver et al., 1989; Mason et al., 2010) or perceived self-efficacy (Benight and Bandura, 2004). For example, high levels of ego-resilience, i.e. an "individual's capacity for flexible and resourceful adaptation to external and internal stressors" (Alessandri et al., 2012, p. 139), were positively associated with more favorable mental health outcomes following traumatic experiences (Philippe et al., 2011). Flood characteristics refer to the severity of exposure or perceived severity of losses. Not surprisingly, severe negative flooding experiences like high property losses or the need to relocation are associated with poorer mental health outcomes (Bubeck and Thieken, 2018; Fernandez et al., 2015; Foudi et al., 2017; Mason et al., 2010),

Social factors refer to general or hazard-related social structures (e.g. flood action groups; (Dittrich et al., 2016) which generate the social support needed to cope with losses due to flooding (Bubeck and Thieken, 2018). In contrast to personal factors and flood characteristics, social factors have received less attention when discussing the impacts of flooding on mental health. Previous work has introduced conceptual distinctions between different types of social support (e.g., emotional, informational and tangible help; (Norris et al., 2005), sources of social support (e.g., partner, family, friends, community members or professionals, Kaniasty and Norris, 2009), and between perceived and received social support (Kaniasty and Norris, 2009; Fernandez et al., 2015). Existing empirical evidence already corroborates the assumption that social support is also beneficial for post-disaster mental health conditions (see Bonanno et al., 2010; Kaniasty and Norris, 2009, for reviews).

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Natural Hazards and Earth System Sciences
Discussions

Less agreement exists, however, about the specific way(s) through which social support can affect mental health outcomes and post-disaster recovery. Previous theorizing has developed three models of how social support may influence the relationship between stress and mental health (Wheaton, 1985). First, the *main-effect model* (or distress deterrent model) assumes a generalized beneficial effect of support on mental health that origins from people's inclusion in tight-knit social networks (see Fig. 1a). Inclusion in tight-knit social networks cannot only provide direct material resources but also psychological resources like a sense of predictability and stability in one's life and positive self-worth. Both types of resources can help individuals to maintain positive affect states (Cohen and Wills, 1985). Second, the *stress-buffering model* states that social support dampens the negative effect of stress on mental health (see Fig. 1b). Statistically, the stress-buffering model assumes that social support moderates the effect of stress on mental health. Past research has identified different stress buffering mechanisms of social support (Cohen and Wills, 1985), for example people's perception that other (individual or collective) actors from their social networks can provide sufficient resources to reduce or mitigate the negative consequences of a threatening situation. If such resources are available, people may alter their appraisals of stressors or change their coping responses (e.g. more problem-focus coping), leading to better adjustment. As a third possibility, the *social support deterioration* model assumes that people who experience severe disaster losses perceive less post-disaster social support and social embeddedness (see Fig. 1c; Kaniasty, 2012; Kaniasty and Norris, 2009). Statistically, this model expects a mediating role of social support on mental health.

(Insert Figure 1 about here)

In the flood context, the empirical evidence for the three models is mixed. A number of studies have corroborated the main-effect model and the social support deterioration model (Bei et al., 2013; Bubeck and Thieken, 2018; Dai et al., 2016; Kaniasty, 2012; Kaniasty and Norris, 2008; Norris et al., 2005; Ruggiero et al., 2009; Wind et al., 2011; Wind & Komproe,

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Discussion started: 14 January 2019

Natural Hazards and Earth System Sciences Discussions

2012). In contrast, less evidence has been found for the stress-buffering model (Benight, 2004). The mixed empirical evidence for the three models, however, might simply be attributable to the fact that previous disaster research has focused on testing the main-effect model and has paid less attention to the stress-buffering model. Conceptually, Cohen and Wills (1985) have hypothesized that the specific effect of social support (main-effect vs. buffering effect) may depend on whether social support is defined as the availability of resources that help to ameliorate the threat (functional measures of social support) or as peoples' degree of integration in social networks (structural measures of social support). They provided first evidence for their assumption that the buffering effect of social support was more pronounced for functional measures of social support than for structural measures. Likewise, Cohen and Wills (1985) found support for the main-effect model when using structural measures. Other results seem to corroborate this reasoning. Benight (2004) found that the buffering effect on post-disaster distress was stronger for collective efficacy as compared to general social support. The measure of collective efficacy used in this study resembled more closely a functional measure of social support, including questions on the community's (physical, financial, non-material) resources to respond effectively to disaster events. In contrast, his measure of social support referred to more general (and not necessarily disaster-related) facets of social support, such as the availability of persons to associate with or to talk to about problems (i.e. structural measure of social support). In line with the findings of Cohen and Wills (1985), Benight's (2004) results showed a main effect of social support (structural measure) but not of collective efficacy (functional measure) on psychological distress. However, as the sample size of the Benight (2004) study was below 50 participants, these findings need further replications.

In sum, previous research has found evidence for the beneficial effects of social support on people's post-disaster adjustment. Less clarity exists about the ways how different forms of social support influence the relationship between disaster-related stress and mental health outcomes (main-effect vs. buffering model). One reason for this might be the lack of

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Discussion started: 14 January 2019

Natural Hazards and Earth System Sciences Discussions

studies that have tested both mechanisms in one study using structural as well as functional social support measures.

The Present Research

The present research has two main objectives. First, we aim to investigate in more detail how flood-related stress (i.e. material and non-material losses due to flooding) and social support may affect mental health outcomes of flooding, both individually and jointly. We therefore test the (relative) predictive power of the main-effect model and the stress-buffering model of social support based on a German community sample affected by flooding. We assume that previous research on flooding has underestimated the effect of social support on mental health by focusing on main effects. A more rigorous analysis needs to investigate possible main and interaction effects of social support to account for the - possibly - multiple ways how support may influence mental health outcomes. Second, previous work has often used measures of *interpersonal* social support or has focused on personal determinants of protective behavior (Begg et al., 2016; see Bamberg et al., 2017, for a meta-analysis). In contrast, *collective-level* factors such as a community's capacity to deal with natural hazards (i.e. community resilience) have received less attention (but see (Lowe et al., 2015). As natural disasters usually pose a challenge not only to single individuals but to society at large, more research is needed to investigate the effects of collective-level variables on post-disaster mental health beyond the effects of interpersonal social support measures (see Fritsche et al., 2018, for a similar social psychological approach to addressing global environmental problems). The present research thus applies measures of interpersonal social support to flooding as well as of collective social support (community resilience). Resilient communities describe communities that can "cope effectively with and learn from adversity" (Pfefferbaum et al., 2011, p. 1). Following our theorizing above, we expect the buffering effect of social support to be more pronounced when applying measures of collective (vs. interpersonal) social support.

More exploratory, the present research also investigates possible downstream consequences of flood-related losses and social support. Specifically, we ask whether flood-

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Discussion started: 14 January 2019

Natural Hazards and Earth System Sciences
Discussions

related losses have a conditional indirect effect on life satisfaction through post-disaster mental health. Previous research found that exposure to natural hazards decrease people's life satisfaction (von Möllendorff and Hirschfeld, 2016).

Extending this work, we test whether post-disaster mental health mediates the relationship between losses and life satisfaction as a function of community resilience.

In sum, the present research aims to complement previous work on the psychological recovery from flooding by investigating in more detail how interpersonal and collective measures of social support affect the association between negative flooding experiences and post-disaster mental health and well-being. More precisely, the empirical part of our article focuses on testing the following hypotheses:

H1: Perceived negative consequences of flooding (e.g., financial and non-financial losses) have a negative direct (main-) effect on post-disaster mental health.

H2: Perceived collective social support (community resilience) has a positive direct (main-) effect on post-disaster mental health.

H3: Perceived interpersonal social support has a positive direct (main-) effect on post-disaster mental health.

H4: Perceived collective social support buffers (moderates) the direct impact of negative consequences on post-disaster mental health.

H5: Perceived interpersonal support buffers (moderates) the direct impact of negative consequences on post-disaster mental health.

H6: Post-disaster mental health has a positive direct effect on life satisfaction.

H7: Post-disaster mental health mediates the effects of perceived negative consequences flooding and social support on life satisfaction.

Method

Sample Characteristics. In June 2016, a severe flood event hit three small towns in the Rottal-Inn district, federal state of Bavaria, Germany. Five people lost their lives and flood-related damages are estimated at roughly €1 billion. Approximately six weeks after the

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Discussion started: 14 January 2019

Natural Hazards and Earth System Sciences
Discussions

disaster, a group of researchers from our team conducted a household survey in these three towns. Local town councils provided us with lists of streets affected by the flood event. We distributed 600 paper-and-pencil surveys and provided households with a link to an online survey. Answers were collected for a period of approximately two months. After excluding participants with missing data, the final sample contains 118 respondents aged from 18 to 80 (46.7% female, M_{age} = 50.73, SD_{age} = 14.70). The majority of the participants were property owners (79.2%) and approximately one third of the participants (32.5%) had previous flood experience.

Measures. Table 1 presents the means, standard deviations, Cronbach's alpha coefficients (provided in parentheses), and inter-scale correlations for each of the variables. Unless otherwise noted, all items used five-point Likert scales. To fit the requirements (space limitations) of a field study, the scales were operationalized with a limited number of items (or single items). We assessed perceived *consequences of the flood event* (i.e. flood-related stress) with four items (six-point scale, 0 = not affected, 1 = not very severe, 5 = very severe). The items referred to the severity of the consequences for respondents' house/flat, other valuables, general financial situation, and their psychological well-being (Begg et al., 2016). Next, we measured *post-disaster mental health*, including measures of psychological and physical distress as well as sense of coherence. Participants answered three items on flood-related *psychological distress* ("How often have you felt [upset, anxious, sad] during the last four weeks?"; 1 = never, 5 = very often) taken from the Short-Form Health Survey (Ware and Sherbourne, 1992). Four items measured flood-related *physical distress* ("How often have you had [headache, heart palpitations, upset stomach, stomachache] during the last four weeks?"; 1 = never, 5 = very often). As an additional health-related variable, a 5-item measure of *sense of coherence* was included in the questionnaire (Schumacher et al., 2000); example item: "When you think about your life, you very often: 1 = feel how good it is to be alive, 5 = ask yourself why you exist at all"). Sense of coherence (Antonovsky, 1988) refers to "people's ability to assess and understand the situation they were in, to find a meaning to move in a

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Discussion started: 14 January 2019

Natural Hazards and Earth System Sciences
Discussions

health promoting direction, also having the capacity to do so" (Eriksson, 2017). Participants then answered a one-item indicator of *life satisfaction* ("All things considered, how satisfied are you with your life as a whole?"; 1 = completely dissatisfied, 5 = completely satisfied).

Perceived *collective social support* (community resilience to natural hazards) was measured with the Communities Advancing Resilience Toolkit Assessment Survey (CART; (Pfefferbaum et al., 2013; Pfefferbaum et al., 2015). The scale had been translated to German by a back-translation procedure. Due to space limitations, we had to reduce the number of items from 21 to 14 items (example items: "People in my community feel like they belong to the community", "My community has resources it needs to take care of community problems (resources include, for example, money, information, technology, tools, raw materials, and services)"; 1 = totally disagree, 5 = totally agree). Participants also answered three items on perceived *interpersonal social support* taken from the social support questionnaire (Fydrich et al.; example item: "I have people close to me, if I need someone to talk to", 1 = totally disagree, 5 = totally agree). Finally, participants were asked to answer a five-item measure of *ego-resilience* (or resilient coping) based on Kocalevent et al. (2017). The scale measures individual differences in people's tendency to cope with stress in an adaptive manner and served as a covariate in the analyses (example item "Regardless of what happens to me, I believe I can control my reaction to it"; 1 = totally disagree, 5 = totally agree).

Results

Analysis strategy. The data was analyzed using SPSS software (hierarchical multiple regression) and Mplus 7.3 software (path analysis, multi group comparison). Following Aiken and West (1991), all interactions were probed at one standard deviation above (+1 SD) and one standard deviation below (-1 SD) the mean of the moderator. All continuous predictors were mean-centered prior to the calculation of the interaction terms.

Hierarchical multiple regression analysis results. Based on their substantive positive inter-correlations (see Table 1), we combined the three measures of psychological and physical distress and sense of coherence into a single measure of post-disaster mental health.

Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2018-389
Manuscript under review for journal Nat. Hazards Earth Syst. Sci.
Discussion started: 14 January 2019

Natural Hazards and Earth System Sciences
Discussions

We recoded the measures in order that higher values indicate better mental health. To test our hypotheses, we submitted the combined measure of post-disaster mental health to hierarchical multiple regression analysis with interaction tests. We included perceived negative consequences of the flood event, perceived collective social support (community resilience) and perceived interpersonal support as predictors in Step 1 of the analysis as well as the two-way interaction terms of perceived consequences and collective and interpersonal social support as additional predictors in Step 2 of the analysis. Results of the regression analyses are shown in Table 2.

In Step 1, the results showed a negative main effect of perceived negative flood consequences (**H1**), β = -.40, $t(116)$ = -4.96, $p < .001$, and a positive main effect of perceived collective social support (**H2**), β = .25, $t(116)$ = 3.00, p = .003, on post-disaster mental health. These effects were qualified by the expected interaction effect of perceived negative flood consequences and collective social support (**H4**) in Step 2, β = .22, $t(114)$ = 2.46, p = .016 (see Figure 2). Simple slope analysis revealed that perceived consequences were negatively correlated with post-disaster mental health only when perceived collective social support was low (-1 SD), unstandardized b = -.30, $t(114)$ = -5.47, $p < .001$, but not at high levels of collective social support (+1 SD), unstandardized b = -.09, $t(114)$ = -1.29, p = .199. For the interpersonal social support measure, results neither showed a significant main (**H3**) nor a significant interaction effect (**H5**). As expected, these findings provide empirical evidence for a substantive buffering effect of social support (stress-buffering model). Furthermore, they indicate that the buffering effect is more pronounced for perceived collective social support than for perceived interpersonal social support. We also conducted separate regression analyses with psychological & physical distress or sense of coherence as dependent variables. Results showed significant interaction effects of perceived consequences and collective social support (community resilience) for both dependent variables (distress & sense of coherence), thus supporting the robustness of our findings.

Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2018-389
Manuscript under review for journal Nat. Hazards Earth Syst. Sci.
Discussion started: 14 January 2019

Natural Hazards and Earth System Sciences
Discussions

To test the stability of our results, we also included ego-resilience as a covariate in the analysis. Results showed a positive main effect of ego-resilience, indicating that respondents who were more psychologically resilient reported better post-disaster mental health. More importantly, the interaction effect of perceived flood consequences and collective social support remained significant, $\beta = .18$, $t(112) = 2.09$, $p = .039$. Our results thus provide evidence for the beneficial effect of collective-level factors (community resilience) beyond individual-level variables such as personal coping styles or a person's mental capacity to cope successfully with stress.

(Insert Figure 2 about here)

Indirect effects: Life satisfaction. Figure 3 presents the results of a path analysis (Mplus 7.3) including life-satisfaction as an additional dependent variable. Life satisfaction is interpreted as a long-term subjective resilience indicator. We found no significant main effect of perceived negative flood consequences on life satisfaction ($\beta = -.03$) or interpersonal social support ($\beta = .08$) but a positive main effect of collective social support on life satisfaction ($\beta = .31$). In line with **H6**, post-disaster mental health showed a statistically significant positive association with life satisfaction ($\beta = .44$). Comparison of indirect effects showed that post-disaster mental health completely mediated the association between negative flood consequences and life satisfaction and partly mediated the association between collective social support and life satisfaction (**H7**). Together, mental health and perceived collective social support explain 35 percent of the variance in life satisfaction. The model depicted in Figure 3 fits the empirical co-variances matrix well ($\chi 2 = 1.95$, $df = 1$, $p = 0.16$, $CFI = 0.99$, $TLI = 0.93$, $RMSEA = 0.09$).

(Insert Figure 3 about here)

More exploratory, we also tested whether the indirect effect of perceived consequences on life satisfaction through mental health was conditional on the level of collective social support (high vs. low collective social support). As we had found a buffering effect of

Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2018-389
Manuscript under review for journal Nat. Hazards Earth Syst. Sci.
Discussion started: 14 January 2019

Natural Hazards and Earth System Sciences
Discussions

collective social support on post-disaster mental health, we tested whether mental health would mediate this buffering effect on life satisfaction. We used the multiple group option of Mplus to test for a possible conditional indirect effect. More precisely, we estimated simultaneously the same association structure between perceived consequences, post-disaster mental health and life satisfaction for participants with lower levels of collective social support ($N = 54$) and participants with higher levels of collective social support ($N = 64$). The median split of the perceived collective social support variable ($Md = 3.14$) was used for creating these two subgroups. Figure 4 presents the results of the multiple group analysis.

(Insert Figure 4 about here)

In the multiple group analysis, the significant interaction effect of perceived flood consequences and collective social support should be reflected in a significantly stronger flood consequences – mental health association in the low collective social support subgroup (i.e. low community resilience subgroup) as compared to the high collective social support subgroup (i.e. low community resilience subgroup). This assumption can be tested with a χ^2 difference test comparing the χ^2 value of a multiple group model specifying the flood consequences – mental health association equal across both subgroups versus a model specifying these path coefficients as free across both groups. The χ^2 difference value resulting from the model comparison is statistically significant ($\chi^2 = 8.42$, df =1, $p < .001$). That is, fixing the flood consequences – mental health path equal across both groups results in a significantly decrease of model fit. As depicted in Figure 4, the estimated negative flood consequences – mental health association is $b = -.34$ (unstandardized path coefficient) for the subgroup with low collective social support (collective support < median). For the high collective social support subgroup (collective support > median), the estimated path coefficient is only $b = -.10$ and statistically insignificant. All other path coefficients could by fixed equal across both subgroups without causing a significant decrease in model fit. The

Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2018-389
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Discussion started: 14 January 2019

Natural Hazards and Earth System Sciences
Discussions

multiple group model depicted in Figure 4 has a good fit ($\chi^2 = 0.64$ df = 2, $p = 0.72$, *CFI* = 1.00, *TLI* = 1.07, *RMSEA* = 0.00).

The indirect effect estimates provided by Mplus can be used for quantifying the indirect buffering effect of collective social support (community resilience) on post-disaster life satisfaction: For the subgroup of participants with lower community resilience, the significant total effect of the perceived negative flood consequences on life satisfaction is 0.21. For the subgroup of participants with higher community resilience, the total effect of the perceived negative flood consequences on life satisfaction is only 0.06, which is statistically insignificant. These results clearly indicate a substantive indirect buffering effect of collective social support on life satisfaction through post-disaster mental health.

Discussion

The present research had two main objectives: To investigate how negative flood experiences and social support are correlated with post-disaster mental health and life satisfaction and to analyze whether these associations would differ as a function of type of social support (collective vs. interpersonal social support). Our analyses are based on a data set of 118 respondents from Germany, surveyed six to twelve weeks after they were affected by a severe flood event.

The results of statistical analyses provide clear answers to both questions: Perceived negative flood consequences were substantively negatively associated with post-disaster mental health while perceived collective social support (community resilience) was positively associated with post-disaster mental health. However, the main effect of collective support was qualified by a statistically significant positive interaction effect of perceived flood consequences (e.g. flood-related losses) and collective social support. Further analysis of this interaction effect demonstrated that perceptions of the flood event as very severe were associated with worse post-disaster mental health only in case of low levels of perceived community resilience (low collective social support). When the community's capability to effectively deal with catastrophic events was perceived as high (high collective support), even

Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2018-389
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Natural Hazards and Earth System Sciences
Discussions

greater flood-related losses were no longer associated with poorer mental health outcomes. This adds further empirical evidence to the so-called stress-buffering model that states that social support dampens the negative effect of stress on mental health (Wheaton, 1985). Including the interaction term of perceived consequences and collective social support in the analysis increased the explanatory power of the statistical model from 23 to 27 percent of the variance explained in post-disaster mental health. In other words, a simple test of the main-effect model of social support would have underestimated the beneficial effect of social support on post-disaster mental health and recovery. Previous flooding research has (sometimes) tended to rely on main effects when discussing the role of social support for mental health outcomes. In contrast, our findings suggest that a more detailed look at this issue might be feasible to better account for the multiple ways how social support can affect mental health and recovery in times of crisis. We thus encourage future research to test the stress-buffering model more frequently to better capture the possible interplay of flood-related stress and social support for their role in post-disaster recovery processes.

Regarding our second question, the present results corroborate the general assumption that social support is beneficial for post-disaster mental health. Yet, they also provide evidence that this buffering effect of support might be stronger for more collective forms of social support (community resilience) as compared to more interpersonal forms of social support (general social support from family, friends etc.). After controlling for collective social support, we found no main or interaction effects of interpersonal social support on the dependent variables. Our results partly support Cohen and Wills (1985) assumptions about the effects of different types of social support on mental adjustment following exposure to stressors. Whereas functional measures of support should have a buffering (i.e. moderator) effect on psychological distress (buffering model), the effects of structural support measures should be more in line with the main-effect model. As our measure of collective social support resembles more closely a functional support measure, the present interaction effect of collective support and perceived flood consequences corroborates Cohen and Wills' (1985)

Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2018-389
Manuscript under review for journal Nat. Hazards Earth Syst. Sci.
Discussion started: 14 January 2019

Natural Hazards and Earth System Sciences
Discussions

reasoning. Contrary to the authors' assumptions however, our data revealed no main effect of interpersonal (i.e. more structural) measures of social support. This might be attributable to the (skewed) distribution of our interpersonal support measure. Mean interpersonal social support ($M = 3.98$) was well above the midpoint of the scale (3), thus possibly restricting the detection of main effects. Another reason might be that the operationalization of the two measures of social support differed not only with regard to their type of support (interpersonal vs. collective support), but also with regard their relevance to flooding. Whereas the collective support measure referred to the community's capacity to deal with natural hazards, the interpersonal support measure referred to general aspects of people's social networks. Although these differences were in part central to our research questions, future research may aim to disentangle the effects of type of support (functional vs. structural) from a possible context effect (flood-related vs. not flood-related).

More exploratory data analyses also indicated that negative flooding experiences have a conditional indirect negative effect on life satisfaction, completely mediated by mental health. Sub-group analyses showed that this indirect negative effect on life satisfaction is substantially reduced when collective social support is high: For the sub-group with low collective social support, negative flooding experiences have a more than three times higher indirect negative impact on post-disaster life satisfaction than for the sub-group with higher collective social support. Again, these findings support our call to account for possible buffering effects of social support - also on the downstream (i.e. more distal) consequences of flooding - by applying appropriate research designs (e.g. moderator analysis).

Conclusion

The present results impressively underline the significance of the social support construct for our understanding of how people cope psychologically with the negative consequences of natural disasters such as floods. The second important insight of the present study consists in the finding that only perceived collective social support but not (general) interpersonal social support was critical for damping the negative psychological effects of severe flood

Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2018-389
Manuscript under review for journal Nat. Hazards Earth Syst. Sci.
Discussion started: 14 January 2019

Natural Hazards and Earth System Sciences
Discussions

experiences. Although the effects of social capital on mental health outcomes have been studied for some time (McPherson et al., 2014; Silva et al., 2005), research on post-flooding recovery has not systematically distinguished between more interpersonal and more collective types of support. This might be somewhat surprising given the fact that flood events are collective phenomena that usually can only be mastered by collective effort. From this perspective, it seems quite self-evident that perceptions of one's own community as being more resilient to natural disasters are associated with less negative mental health outcomes at the individual level, as suggested by our results. Nevertheless, our findings have important theoretical and practical implications.

Conceptually, our results suggest that it might be feasible for future research to put a stronger focus on collective-level processes and resources as well as on possible interactive effects of (personal, flood-related, social) factors when thinking about how people cope with flood events. Because of the correlational nature of our results, the assumed causality of the described associations between collective social support and post-disaster mental health remains, however, insecure. Thus, longitudinal or (when possible) experimental tests of the effects of the different types of social support are necessary for clarifying causality. Recent findings lend some support to this claim (Lowe et al., 2015; Wind and Komproe, 2012). Applying a longitudinal design, Matsuyama et al. (2016) found that both individual-level and community-level social support independently and positively contributed to post-disaster mental health of earthquake survivors in Japan. Future research may investigate how different types of social support interact with personal or flood-related factors to influence mental health outcomes. Such a research focus would also promote a more systematic integration of the psychological literature on coping with stressful events and the sociological literature on the social capital concept. After all, social networks are the central structural component of the social capital concept (Coleman, 1988, Portes, 1998, Putnam, 2000). Social capital does not refer to individuals, but to the relationships among individuals. It thus provides access to the resources of social and social life such as support, assistance, recognition, knowledge and

Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2018-389
Manuscript under review for journal Nat. Hazards Earth Syst. Sci.
Discussion started: 14 January 2019

Natural Hazards and Earth System Sciences
Discussions

459 connections. Combining psychological research with research on the different dimensions of
460 social capital (structural, cognitive, relational dimensions; Nahapiet and Ghoshal, 1998) might
461 further our understanding of how personal, flood-related and social factors (jointly) contribute
462 to resilience and post-disaster well-being.

463 Including collective-level variables (such as community resilience) in models of post-
464 disaster adjustment would also have important practical implications. Currently, most flood
465 intervention programs are targeted at (the promotion of) individual protective behaviors
466 (Bamberg et al., 2017). Focusing on models of collective behavior (Fritsche et al., 2018)
467 could foster the development of theory-based interventions that also promote collective (e.g.
468 communal) support systems. As an example of such interventions, the Communities
469 Advancing Resilience Toolkit (CART) aims to assist communities in systematically enhancing
470 their resilience to disasters (Pfefferbaum et al., 2013, 2015). CART is a community-driven
471 intervention that consists of a strategic planning process for building community resilience to
472 disasters with instruments for collecting data to develop and implement resilience-building
473 strategies. Previous applications of the CART survey instrument have corroborated the
474 proposed model structure (Pfefferbaum et al., 2015; Pfefferbaum et al., 2013), but
475 (longitudinal) evaluations of the community toolkit as an intervention program are a pending
476 task for future research. We are convinced that theory-based development, implementation,
477 and evaluation of collective-level interventions provide a feasible avenue for social science
478 disaster research both theoretically and practically.
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Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2018-389
Manuscript under review for journal Nat. Hazards Earth Syst. Sci.
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Manuscript under review for journal Nat. Hazards Earth Syst. Sci.
Discussion started: 14 January 2019

Natural Hazards and Earth System Sciences
Discussions

690 Table 1

691 *Means, standard deviations, Cronbach's alpha coefficients (provided in parentheses), and*
692 *inter-scale correlations between variables*

Variable	M	SD	1.	2.	3.	4.	5.	6.	7.	8.
1. Consequences flood event	2.62	1.54	(.84)	.40***	.33***	-.28**	-.14	-.01	.04	.08
2. Psychological distress	3.25	1.06		(.73)	.58***	-.56***	-.26**	-.14	.08	-.19*
3. Physical distress	2.57	1.15			(.83)	-.47***	-.29**	-.06	-.02	-.07
4. Sense of coherence	3.49	0.85				(.78)	.59***	.39***	.20*	.29**
5. Life satisfaction	3.66	0.95					[a]	. 45***	.19*	.10
6. Collective social support	3.17	0.70						(.90)	.22*	.16
7. Interpersonal social support	3.98	0.69							(.89)	.21*
8. Ego-resilience	3.83	0.69								(.75)

693 *Note.* * $p < .05$; ** $p < .01$; *** $p < .001$; [a] Cronbach's alpha not computed (single item measure)
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Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2018-389
Manuscript under review for journal Nat. Hazards Earth Syst. Sci.
Discussion started: 14 January 2019

Natural Hazards and Earth System Sciences
Discussions

Table 2

Hierarchical regression of the combined post-disaster mental health measure on perceived negative consequences, perceived collective social support (community resilience), perceived interpersonal social support and their interaction terms

Step		*ß*	*SE*	R^2	*adj.* R^2	ΔR^2	*F*
1	*DV: post-disaster mental health*			.23	.21	.23***	11.28***
	Perceived consequences	.44***	.05				
	Collective social support	-.18*	.12				
	Interpersonal social support	.10	.08				
2	*DV: post-disaster mental health*			.27	.24	0.04*	9.62***
	Consequences x collective support	-.21**	.08				
	Consequences x interpersonal support	.13^{+}	.08				

Note. $^{+}p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2018-389
Manuscript under review for journal Nat. Hazards Earth Syst. Sci.
Discussion started: 14 January 2019

Natural Hazards and Earth System Sciences
Discussions

717 Figure Captions

718 Figure 1

719 *Different models of the relationship between social support and mental health outcomes*

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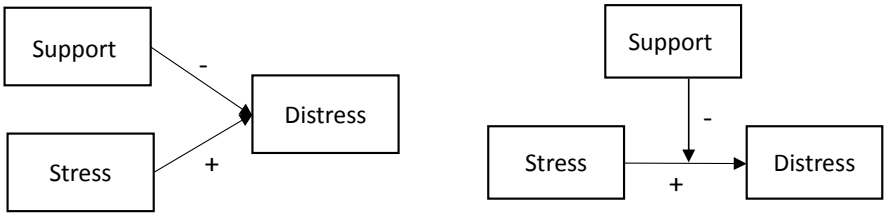

725 a) Main-effect model b) Stress-buffering model

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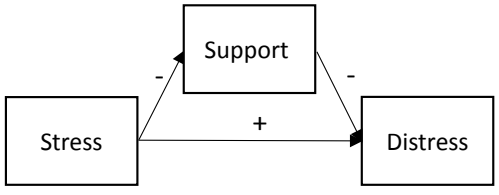

730 c) Social support deterioration model

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732

733 Figure 2

734 *Combined post-disaster mental health measure (1 to 5) as a function of flood-related negative*
735 *consequences and perceived collective social support (community resilience)*

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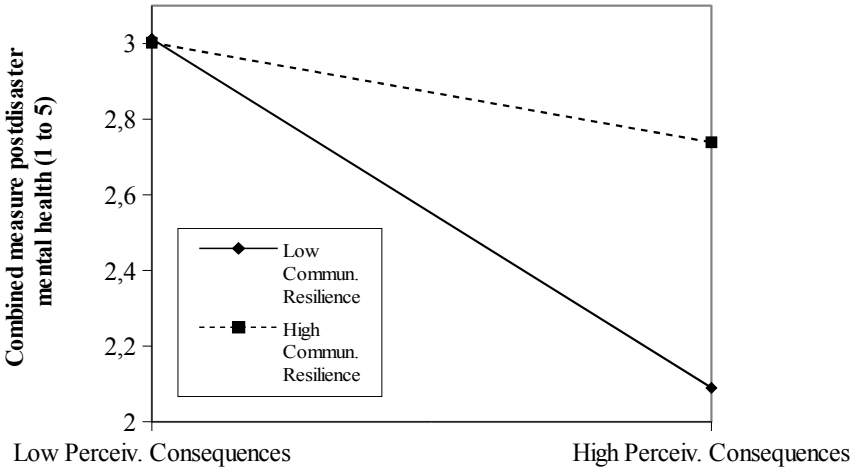

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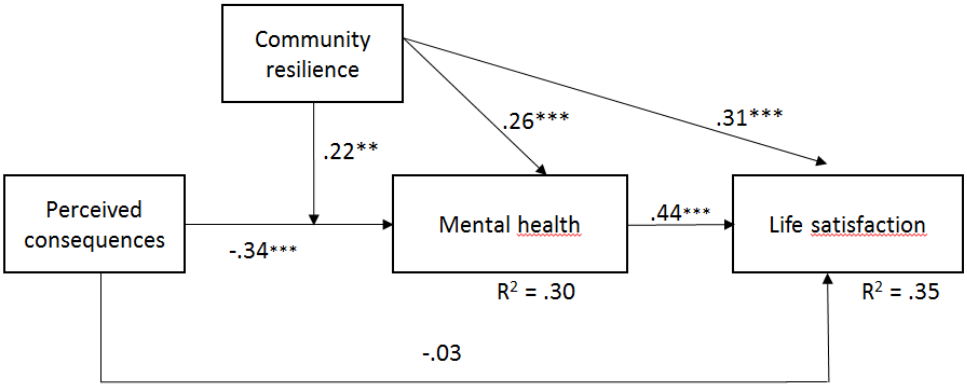
Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2018-389
Manuscript under review for journal Nat. Hazards Earth Syst. Sci.
Discussion started: 14 January 2019

Figure 3

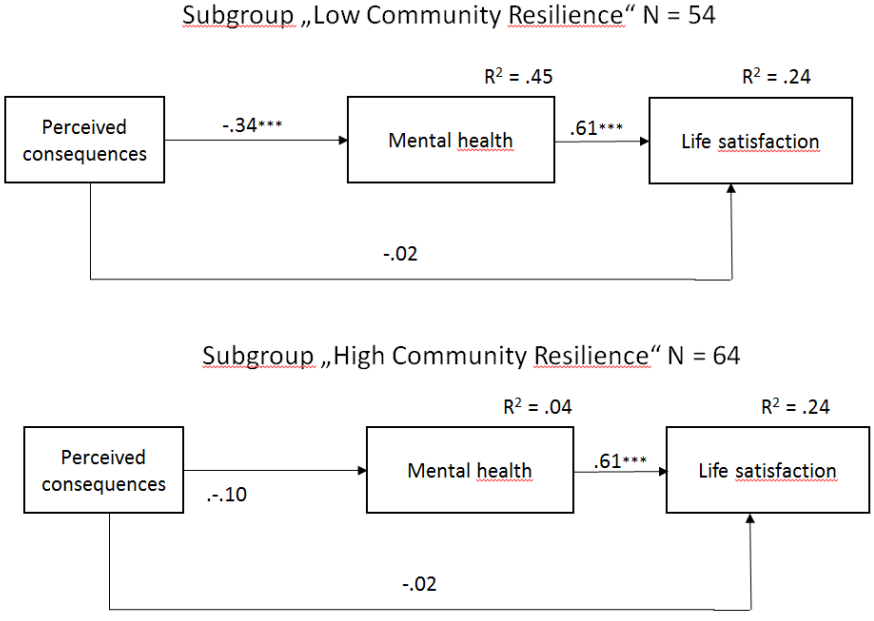
Path model with life satisfaction as dependent variable



*Note. N = 118; standardized path coefficients; R^2 = explained variance; *** = p < .001, ** p < .01*

Figure 4

Results of the multiple group analysis



*Note. unstandardized path coefficients; R^2 = explained variance; *** = p < .001, ** p < .01*